

ABSTRACT OF THE DISCLOSURE

Human pre-formed xenoantibodies play an important role in the hyperacute rejection response in human xenotransplantation. Disclosed are materials and methods for removing or neutralizing such antibodies. Also disclosed are materials and methods for reducing or eliminating the epitopes in the donor organs that are recognized by such antibodies. Such epitopes are formed as the result of activity by the enzyme  $\alpha$ -1,3 galactosyltransferase. The porcine gene encoding  $\alpha$ -1,3 galactosyltransferase is disclosed, as are materials and methods for inactivating ("knocking out") the  $\alpha$ -1,3 galactosyltransferase gene in mammalian cells and embryos. Included are nucleic acid constructs useful for inactivating the  $\alpha$ -1,3 galactosyltransferase gene in a target cell. Also disclosed is a novel leukemia inhibitory factor (T-LIF) that is useful for maintenance of embryonic stem cells and primordial germ cells in culture.